ARSD College, University of Delhi

Model Course Handout/Lesson Plan

Course Name : B.Sc. (Physics Science) Electronics						
Semester	**Course Code**	**Course Title**	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Credit (C)**
IV	42224303	Thermal Physics and Statistical Mechanics	4	0	0	4
Teacher/Instructor(s)		Dr. Abid Hussain and Dr. Amit K. Vishwakarma				
Session		2022-23				

Course Objective:

This course will introduce Thermodynamics, Kinetic theory of gases and Statistical Mechanics to the students. The primary goal is to understand the fundamental laws of thermodynamics and its applications to various thermodynamical systems and processes. This coursework will also enable the students to understand the connection between the macroscopic observations of physical systems and microscopic behavior of atoms and molecules through Statistical mechanics.

Course Learning Outcomes:

- Learn the basic concepts of thermodynamics, the first and the second law of thermodynamics, the concept of entropy and the associated theorems, the thermodynamic potentials and their physical interpretations. They are also expected to learn Maxwell's thermodynamic relations.
- Know the fundamentals of the kinetic theory of gases, Maxwell-Boltzman distribution law, equipartition of energies, mean free path of molecular collisions, viscosity, thermal conductivity, diffusion and Brownian motion.
- Learn about the black body radiations, Stefan- Boltzmann's law, Rayleigh-Jean's law and Planck's law and their significances.
- Learn the quantum statistical distributions, viz., the Bose-Einstein statistics and the Fermi-Dirac statistics.

Lesson Plan:

Unit No.	Learning Objective	Lecture No.	Topics to be covered
1.	Thermodynamic Description of system	22	Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between Cp and Cv, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Coefficient, Reversible and irreversible processes, Second law, Entropy, Carnot's cycle & theorem, Entropy changes in reversible and irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.
2.	Thermodynamic Potentials	10	Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations and applications - Joule-Thomson Effect, Clausius Clapeyron Equation, Expression for (Cp – Cv), Cp/Cv, TdS equations.
3.	Kinetic Theory of Gases	10	Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.
4.	Theory of Radiation	6	Blackbody radiation, Spectral distribution, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.
5.	Statistical Mechanics	12	Microstate and Microstate, Phase space, Entropy and Thermodynamic probability, Maxwell-Boltzmann law, Quantum statistics, Fermi-Dirac distribution law, Bose-Einstein distribution law, comparison of three statistics.

Evaluation Scheme:

No.	Component	Duration	Marks
1.	Internal Assessment		25
	• Class Test		
	• Assignment		
	• Attendance		
2.	End Semester Examination	3 h	75

Details of the Course		
Unit	**Contents**	**Contact Hours**
1	Thermodynamic Description of system	22
2.	Thermodynamic Potentials	10
3.	Kinetic Theory of Gases	10
4.	Theory of Radiation	6
5.	Statistical Mechanics	12
	Total	**60**

Suggested Books:

Sl. No.	Name of Authors/Books/Publishers
1	Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
2	A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
3	Heat and Thermodynamics, M.W. Zemasky and R. Dittman, 1981, McGraw Hill
4	Statistical Physics, Franz Mandl, 1988, 2nd Edition. Wiley.

Mode of Evaluation:	Internal Assessment / End Semester Exam